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ABSTRACT

The program guide for commercial refrigeration technology courses in Florida identifies primary considerations for the organization, operation, and evaluation of a vocational education program. Following an occupational description for the job title for refrigeration mechanic, and its Dictionary of Occupational Titles code, are six sections providing: (1) a description of program content, including a curriculum framework, student performance standards, major concepts, and laboratory activities; (2) program implementation information, such as teacher characteristics, student admission criteria, cooperation education program description, and student organizations; (3) seven resources listed by performance standards; (4) information on facility design; (5) a list of suggested equipment related to student performance standards; and (6) information on teacher professional development resources and organizations. The attached Career Merit Achievement Plan (Career MAP) for commercial refrigeration technology charts the competencies required for entry into the field of commercial refrigeration. It was developed to display the student performance standards required by the local education agencies and to document the level of achievement on student performance standards that individual students demonstrate. (KC)

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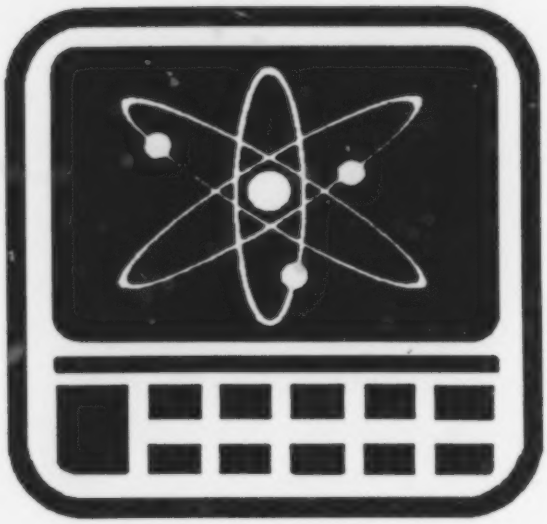

FLORIDA VOCATIONAL PROGRAM GUIDE FOR

COMMERCIAL REFRIGERATION TECHNOLOGY

Prepared by

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June, 1993

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INTRODUCTION

Vocational education meets the needs of students desiring to pursue a selected vocation and is designed to provide training that is realistic in meeting present and future employment opportunities. In recent years, applications of science and technology have expanded rapidly, increasing the education and training required of workers. This has made vocational training programs more attractive as an educational option. The new technologies require well-trained workers to carry out both standardized and specialized procedures, and whose training foundations have given them the capacity to keep pace with continuing technology demands.

The Florida Department of Education shares with business and industry the determination to provide opportunities for upward mobility to as many Floridians as possible. Vocational training programs can keep pace with the demands of new industrial patterns and can provide the opportunity for many of our citizens to gain financial stability and an improved sense of self worth. Therefore, it is necessary to create exemplary vocational programs and to make those programs consistent throughout the state.

This Program Guide identifies primary concerns that should be considered in the organization, operation and evaluation of a vocational education program. It has been developed to provide useful information to local school district and community college administrators, instructors, program advisory committees, regional coordinating councils and others charged with the responsibility of offering vocational education programs.

OCCUPATIONAL DESCRIPTION

A principle occupational title is identified for each vocational training program. This title is validated by the United States Department of Labor Dictionary of Occupational Titles (DOT) or other appropriate references. Such references may be the United States Department of Commerce Standard Occupational Classification Manual (SOC), the Occupational Employment Statistics Survey Dictionary (OES), or Vocational Preparation and Occupations (VPO) prepared by the National and State Occupational Information Coordinating Committees. Information obtained from industry advisory committees may also be used to validate the principle occupational title. The job title and code number for this program are listed in the curriculum framework which accompanies this guide.

The United States Department of Labor Dictionary of Occupational Titles (D.O.T.) identifies the job title for this occupational area as follows:

D.O.T. JOB TITLE	D.O.T. CODE
Refrigeration Mechanic	637.261-026

The definition (description) for this job title is taken from the D.O.T. for easy reference.

REFRIGERATION MECHANIC (any ind.)

Installs and repairs industrial and commercial refrigerating systems according to blueprints and engineering specifications, using knowledge of refrigeration, structural layout, and function and design of components: Lays out reference points for installation of structural and functional components, using measuring instruments, such as tape, transit, plumb bob, levels, and square. Drills holes and installs mounting brackets and hangers into floor and walls of building. Lifts and alines components into position, using hoist or block and tackle. Screws, bolts, rivets, welds, and brazes parts to assemble structural and functional components, such as motors, controls, switches, gages, wiring harnesses, valves, pumps, compressors, condensors, cores, and pipes. Cuts, threads, and connects pipe to functional components and water or power system of premises. [PIPE FITTER (const.)]. Pumps specified gas or fluid into system. Starts system, obs erves operation, reads gages and instruments, and adjusts mechanisms, such as valves, controls, and pumps to control level of fluid, pressure, and temperature in system. Dismantles malfunctioning systems and tests components, using electrical, mechanical, and pneumatic testing equipment.

Replaces or adjusts defective or worn parts to repair systems. May insulate shells and cabinets of systems. May install wiring to connect components to electric power source. May specialize in installing systems and be designated REFRIGERATION-SYSTEM INSTALLER (any ind.).

PROGRAM CONTENT

The Division of Vocational, Adult, and Community Education, as required by State Board of Education **(S.B.E.) Rule 6A-6.0571**, publishes Vocational Education Program Courses Standards annually. This document specifies the minimum program content for the operation of a vocational training program for the occupational titles listed. Each program identified in the Florida Department of Education Course Code Directory is required to establish course standards. The standards for each vocational offering are comprised of two major components: (1) Curriculum Framework and (2) Student Performance Standards.

Curriculum Framework (CF)

The Curriculum Framework specifies the exact course title, course number, levels of instruction, major course content, laboratory activities, special notes, major course concepts and intended outcomes. The program requirements stipulated in the curriculum framework have been approved by the State Board of Education and are the legal bases for delivery of instruction.

Student Performance Standards (SPS)

The Student Performance Standards are a resource list of job-specific competencies. This list is generated and approved by industry experts and becomes the basis for curriculum development in vocational programs. Local school districts and community colleges must, by law, adopt student performance standards for their vocational programs. They may, at their discretion, adopt the list provided or develop their own as long as there is sufficient content to address each intended outcome. A program may provide instruction beyond the minimum specified in the SPS if desired. The decision to do this should be based on local industry needs. However, the minimum must be presented.

The SPS for secondary level programs contain a third component, course structure. This component specifies the number of courses required for program completion and the content of each course. The courses may be taught in any sequence, but the content may not be changed unless approved by the Division of Vocational, Adult, and Community Education.

The curriculum framework and student performance standards are intended for use as a guide, not a teaching tool. Teachers or curriculum development personnel are expected to develop or select complete curriculum materials for their training programs based on the curriculum framework and student performance standards. Each intended outcome and SPS should be thoroughly analyzed for related cognitive and procedural subskills. The curriculum framework and student performance standards are presented in the following pages.

PROGRAM CONTENT COMMERCIAL REFRIGERATION TECHNOLOGY

CURRICULUM FRAMEWORK PROGRAM AREA: Industrial

FLORIDA DEPARTMENT OF EDUCATION EFFECTIVE DATE: July 1993

PROGRAM TITLE: Commercial Refrigeration Technology

CODE NUMBER: Secondary Postsecondary I470321

Florida CIP 0647.023100

SECONDARY SCHOOL CREDITS ____ COLLEGE CREDITS ___ POSTSECONDARY ADULT VOCATIONAL CREDITS x

APPLICABLE LEVEL(S): ___7-9 _____9-12 __x__ Postsecondary Adult Vocational

__x__ Postsecondary Vocational ___ Other 30-31

CERTIFICATION COVERAGE: AC HEAT ME @ 7 G REFRG MECH @ 7 G

I. MAJOR CONCEPTS/CONTENT: The purpose of this program is to prepare students for employment as commercial refrigeration installer-servicers (637.261-026), or to provide supplemental training for persons previously or currently employed in these occupations. Individuals completing this program will be qualified to work in the industry as commercial refrigeration technicians.

The course content includes, but is not limited to, planning installation, testing and servicing of commercial refrigeration systems and components; servicing, installation and troubleshooting electrical and mechanical components; testing, diagramming and solving problems in commercial refrigeration equipment; record keeping; supervisory skills; use and care of hand tools, power tools, specialized tools and equipment; and use of current industry standards, practices and techniques.

II. LABORATORY ACTIVITIES: Shop or laboratory activities are an integral part of this program and provide instruction in brazing and soldering tubing and piping, installing and servicing controls and components, electrical wiring, troubleshooting of electrical and mechanical systems, routine maintenance and service, use of specialized tools and equipment, job estimating and code compliance.

III. SPECIAL NOTE: The Vocational Industrial Clubs of America, Inc., is an appropriate vocational student organization for providing leadership

training experiences and reinforcing specific vocational skills. When provided, these activities are considered an integral part of this instructional program.

In accordance with Section 233.0695 F.S., the minimum basic skills grade level required for this postsecondary adult vocation programs is: Mathematics 10.0, Language 9.0, Reading 9.0. This grade level number corresponds to a grade equivalent score obtained on a state designated basic skills examination.

The cooperative method of instruction may be utilized for this program. Whenever the cooperative method is offered, the following is required for each student: A training plan, signed by the student, teacher and employer which includes instructional objectives and a list of on-the-job and in-school learning experiences; a work station which reflects equipment, skills and tasks relevant to the occupation the student has chosen as a career goal. The student must receive compensation for work performed.

To be transferable statewide between institutions, this program/course must have been reviewed, and a 'transfer value' assigned the curriculum content by the appropriate Statewide Course Numbering System discipline committee. This does not preclude institutions from developing specific program or course articulation agreements with each other.

The program may be offered in courses. vocational credit shall be awarded to the student on a transcript in accordance with Section 230.643 F.S.

The average length of this program for the typical student is 1800 hours when content form the Florida common core air conditioning refrigeration and heating program (Air Conditioning, Refrigeration and Heating Mechanics) is included.

IV. INTENDED OUTCOMES: After successfully completing this program, the student will be able to:

01. Demonstrate a basic understanding of refrigeration.
02. Demonstrate proficiency in refrigeration cycle/diagrams.
03. Demonstrate a knowledge of refrigeration-servicing and testing equipment.
04. Demonstrate proficiency in refrigeration-piping materials and fabrication.
05. Demonstrate proficiency refrigeration pipe sizing and troubleshooting.
06. Demonstrate proficiency in basic electricity.
07. Demonstrate proficiency in electrical generation and distribution.
08. Demonstrate proficiency in electrical components/motors.

09. Demonstrate proficiency in solid state electronics.
10. Demonstrate proficiency in commercial and engineered control systems.
11. Demonstrate an understanding of refrigeration load.
12. Demonstrate proficiency in psychrometrics.
13. Demonstrate proficiency in metering devices.
14. Demonstrate proficiency in compressors.
15. Demonstrate proficiency in condensers.
16. Demonstrate proficiency in evaporators.
17. Demonstrate an understanding of accessories.
18. Demonstrate an understanding of commercial refrigeration-system application.
19. Demonstrate an understanding of refrigerated storage systems.
20. Diagnose and repair ice machines.

STUDENT PERFORMANCE STANDARDS EFFECTIVE DATE: July, 1993

PROGRAM AREA: Industrial SECONDARY NUMBER: _____

PROGRAM TITLE: Commercial Refrigeration Technology POSTSECONDARY NUMBER: _____

01.0 DEMONSTRATE A BASIC UNDERSTANDING OF REFRIGERATION -- The student will be able to:

01.01 Demonstrate a basic understanding and appreciation of air conditioning and its impact on society.

02.0 DEMONSTRATE PROFICIENCY IN REFRIGERATION CYCLE/DIAGRAMS -- The student will be able to:

02.01 Identify all zones and lines on the pressure enthalpy (PH) chart.
02.02 State the unit of measurement for H (Btu/lb).
02.03 Define enthalpy and entropy.
02.04 Diagram a simple cycle using the pressure enthalpy (PH) chart.
02.05 Show arrows for direction of cycle on the (PH) chart.
02.06 Calculate qe on the (PH) chart.
02.07 Calculate qw on the (PH) chart.
02.08 Calculate qc on the (PH) chart.

03.0 DEMONSTRATE A KNOWLEDGE OF REFRIGERATION-SERVICING AND TESTING EQUIPMENT -- The student will be able to:

03.01 Double and triple evacuate system with a two stage vacuum pump.
03.02 Properly use a micron gauge.
03.03 Properly use a mercury U-tube.

04.0 DEMONSTRATE PROFICIENCY IN REFRIGERATION -PIPING MATERIALS AND FABRICATION -- The student will be able to:

04.01 Describe procedures used to protect valves/fittings from heat damage.
04.02 Describe the applications of vibration eliminators.
04.03 Identify and select correct insulation for application.

05.0 DETERMINE PROFICIENCY IN REFRIGERATION-PIPE SIZING AND TROUBLESHOOTING -- The student will be able to:

05.01 Determine capacities of refrigerant lines.
05.02 Determine equivalent lengths of fittings.
05.03 Calculate total effective length of pipe run.
05.04 Calculate amount of refrigerant in lines.
05.05 Describe use of traps in suction risers.

05.06 Explain pressure drop.
05.07 Explain saturation temperature drop.
05.08 Calculate pressure drop in liquid line risers.
05.09 Size double risers.
05.10 Size hot gas lines.
05.11 Size liquid line from condenser to receiver.

06.0 DEMONSTRATE PROFICIENCY IN BASIC ELECTRICITY -- The student will be able to:

06.01 Define and compare single and multi-phase voltage and current.
06.02 Use Ohm's law to calculate various circuit quantities.
06.03 Calculate electrical circuit loads.
06.04 Interpret tables and charts from National Electrical Code (NEC).

07.0 DEMONSTRATE PROFICIENCY IN ELECTRICAL GENERATION AND DISTRIBUTION -- The student will be able to:

07.01 Demonstrate the ability to figure wire sizes and voltage drop.
07.02 Draw and identify power transformer types.
07.03 Size and test fuses and breakers and safely replace them.

08.0 DEMONSTRATE PROFICIENCY IN ELECTRICAL COMPONENTS/MOTORS -- The student will be able to:

08.01 Define electromotive force, counter electromotive, torque and rotation.
08.02 Explain the operation and application of a three phase motor.
08.03 Explain the operation and application of shaded pole.
08.04 Explain the operation and application of permanent split capacitor.
08.05 Demonstrate proper use of testing equipment for motors.
08.06 Describe lubrication methods for motors.

09.0 DEMONSTRATE PROFICIENCY IN SOLID STATE ELECTRONICS -- The student will be able to:

09.01 Explain basic solid state circuits.
09.02 Identify, test, and replace circuit boards.

10.0 DEMONSTRATE PROFICIENCY IN COMMERCIAL AND ENGINEERED CONTROL SYSTEMS -- The student will be able to:

10.01 Identify electromechanical control systems.
10.02 Identify electronic control systems.
10.03 Identify programmable control systems.
10.04 Describe sequences of operation of types of control systems.

11.0 DEMONSTRATE AN UNDERSTANDING OF REFRIGERATION LOAD -- The student will be able to:

11.01 Define "U" value (BTu/hr. ft2-F).
11.02 Define "K" value (Fft2 hr./BTu).
11.03 Define "C" value (Fft2 hr./BTu).
11.04 Define "R" value (Fft2 hr./BTu).
11.05 Interpret heat transfer tables ("U, K, C, R").
11.06 Calculate total heat transfer value of any surface (R) - (U).
11.07 Explain conduction heat load source.
11.08 Explain infiltration as a heat load source.
11.09 Explain product heat load source.
11.10 Explain misc. loads (people, motors, equipment) as heat sources.
11.11 Explain the purpose of vapor barriers.
11.12 Interpret tables of specific heat values, intent heat and heat of respiration.

12.0 DEMONSTRATE PROFICIENCY IN PSYCHROMETRICS -- The student will be able to:

12.01 Identify the dry bulb line (DB).
12.02 Identify the wet bulb line (WB).
12.03 Identify relative humidity (RH).
12.04 Identify dew point (DP).
12.05 Identify enthalpy (h).
12.06 Identify specific humidity (grains of moisture) or (Lbw/Lbda).
12.07 Calculate refrigeration sensible heat ratio.

13.0 DEMONSTRATE PROFICIENCY IN METERING DEVICES -- The student will be able to:

13.01 Define AEV.
13.02 Define low side float.
13.03 Define high side float.
13.04 Define hand expansion valve.
13.05 Evaluate system performance when using different types of flow control devices.

14.0 DEMONSTRATE PROFICIENCY IN COMPRESSORS -- The student will be able to:

14.01 Describe screw methods of compression.
14.02 Describe scroll methods of compression.
14.03 Select the correct compressor based on cooling load.
14.04 Describe the operation of reciprocating compressors.
14.05 Describe lubrication methods for compressors.
14.06 Describe the methods of compressor unloading.

15.0 DEMONSTRATE PROFICIENCY IN EVAPORATORS -- The student will be able to:

15.01 Identify and describe evaporative condenser.
15.02 Determine proper air and water flow.
15.03 Adjust the air flow for proper temperature difference.
15.04 Adjust water flow for proper GPM and temperature difference.

16.0 DEMONSTRATE PROFICIENCY IN EVAPORATORS -- The student will be able to:

16.01 Identify and explain the operation of the different types of evaporator coils.

17.0 DEMONSTRATE AN UNDERSTANDING OF ACCESSORIES -- The student will be able to:

17.01 Identify the proper location of accumulators.
17.02 Identify the proper location of suction filters.
17.03 Identify the proper location of oil separators.
17.04 Identify the proper location of head pressure controls.
17.05 Identify the proper location of solenoid valves.
17.06 Identify the proper location of evaporator pressure regulating valve.
17.07 Identify the proper location of crankcase regulating valves.
17.08 Identify the proper location of heat exchangers.
17.09 Identify types and location of freeze protection.

18.0 DEMONSTRATE AN UNDERSTANDING OF COMMERCIAL REFRIGERATION-SYSTEM APPLICATION -- The student will be able to:

18.01 Explain the operation of a single compressor/evaporator system.
18.02 Explain the multiplex system.
18.03 Explain the cascade system.
18.04 Explain how to set superheat on a multiplex system.
18.05 Explain the heat reclaim cycle (three way value).
18.06 Explain the head pressure control system (flooded condenser).
18.07 Adjust EPR value.
18.08 Check the suction stop valve.
18.09 Check system for full refrigerant charge.
18.10 Charge system with refrigerant on liquid side as well as suction side.
18.11 Adjust all operating and safety controls.
18.12 Replace filter driers.
18.13 Check oil.
18.14 Change oil.

19.0 DEMONSTRATE AN UNDERSTANDING OF REFRIGERATED STORAGE SYSTEMS -- The student will be able to:

19.01 Explain the difference between medium temperature, low temperature, and ultra low temperature storage systems.

19.02 Identify service cases and self-service cases.
19.03 Explain the difference between service cases and self-service cases.
19.04 Explain the operation of air screen freezers.
19.05 Explain the operation of glass door freezers.
19.06 Explain the operation of coffin cases.
19.07 Explain the electrical resistance method of defrost.
19.08 Explain the hot gas method of defrost.
19.09 Explain the cool gas method of defrost.
19.10 Replace anti sweat heaters.
19.11 Replace fan motors and fans.
19.12 Check and/or replace fan delay.
19.13 Measure and verify air flow.
19.14 Clean drain line.

20.0 DIAGNOSE AND REPAIR ICE MACHINES -- The student will be able to:

20.01 Explain the operation of ice making.
20.02 Follow manufacturers' instructions for cleaning the evaporator.
20.03 Clean the condenser.
20.04 Check the harvest cycle.
20.05 Adjust cube size.
20.06 Check metering device for proper operation.
20.07 Check grid heaters when applicable.
20.08 Clean ice storage area.
20.09 Replace bearing in flake type machine.
20.10 Check water level.
20.11 Check water pressure.
20.12 Check for machine level.
20.13 Check water pump.
20.14 Check water spray.
20.15 Identify and explain the types of water treatment.

PROGRAM IMPLEMENTATION

It is the teacher's responsibility to ensure that students learn how to competently perform the tasks specified in the course objectives. Therefore, the teacher must lead the students through the learning experiences in a course, motivate students, act as a role model for students, and at times, function as a guidance counselor and placement coordinator. This leadership role requires the teacher to participate in many of the activities required for program implementation. The teacher must select the methods of instruction that best apply to students' ability levels, measure student achievement and provide feedback. Key factors that must be considered when implementing this program are addressed below.

TEACHER CHARACTERISTICS

Subject Knowledge

The teacher must be a subject matter expert who is able to implement sound instructional methods and evaluate student performance. He/she must have significant work experience in the industry/vocational field and be able to communicate that knowledge to the students.

Instructional Delivery

The teacher's role in the learning process is to motivate and lead the student as well as impart subject matter knowledge. In order to maximize student learning, the use of a variety of instructional methods is encouraged. Because teaching styles vary greatly, teachers are highly encouraged to "pick and choose" from various methods or to combine methods for maximum benefit to students. Some of the more traditional methods used are lecture, demonstration and small group instruction. Other teaching methods which are suggested for further exploration include individualized self-paced, open-exit/open-entry, contract, computer based and competency based instruction. The focus of Competency Based Vocational Education (CBVE) is to ensure that each student can competently perform tasks specified before progressing to more complex skills.

CONVENTIONAL INSTRUCTIONAL METHODS

A vocational program may require a portion of the instruction to be presented in a standard lecture or controlled demonstration format. These methods of instruction can be easily combined with instructor controlled step-by-step practical exercises. Some instructional activities may dictate that this instructional approach be used to introduce students to hazardous equipment often utilized in vocational training. In most situations, students should be required to perform specified activities to achieve maximum skill competency. If mastery of a task is required, competency based education methods may be more appropriate. However, if the training activity involves an orientation or a seldom performed, non-essential task, conventional instructional methods may be more effective. Teachers are encouraged to use a variety of instructional methods to best meet instructional objectives.

Instructional Development

Teachers often must develop and select their own teaching and curriculum materials. In developing a comprehensive curriculum, instructional objectives based upon both the performance and cognitive domain must be included. When developing curriculum materials, teachers must use the curriculum framework (CF) and student performance standards (SPS) contained in this program guide as a basis. These materials delineate minimim program content which must be presented for an approved vocational training program. However, they are not intended for use as a comprehensive curriculum. Be certain not to adapt the curriculum to available materials, but select only those materials which can be adapted to the curriculum.

Instructional Measurement

Teachers must select testing methods that support the instructional delivery system used. Teachers must be competent to develop, administer and evaluate written and performance type tests.

Student Admissions Criteria

Providing the student the opportunity to successfully complete a vocational education program, in any institution, should be the primary concern of the instructional effort. Therefore, it is very important to direct planning and effort into identifying and selecting students with excellent potential for success in the educational program and in the occupation. The school's primary task is to prepare people for fulltime, entry-level positions as technicians or, in the case of those with more experience, as managers.

The Course Code Directory, specifies grade levels at which occupational programs are offered. Specific student admissions criteria which are required by the State and local educational agencies for the Commercial Refrigeration training program are illustrated as follows.

SPECIFIC ADMISSIONS CRITERIA

Minimum Age:	As required by state and local policy
Physical Requirements:	None
Special Requirements:	None
Minimum Basic Skills Math Level:	* 10.0
Minimum Basic Skills Language Level:	* 9.0

* This grade level requirement is specified in the Curriculum Framework and is applicable to postsecondary level programs of 450 hours or more only. There is no minimum basic skill requirement for secondary programs.

THE STUDENT PROFILE

Developing a student profile is an important step in program implementation. Attention should focus on student characteristics that can be remediated within a training program, but could create serious impediments to success in the vocational field. Typical of these would be deficiencies in communication and mathematical skills. The basic skill levels can be measured by testing. Test results can then be used to direct the student to more suitable training which matches his or her skill level, or to determine supplemental training which may be required to increase chances for student success.

High school and postsecondary vocational students can be admitted to a vocational program upon request if they meet any specified prerequisites, such as physical or basic skill requirements. Training programs should be accessible to as many students as possible. Training programs are designed to prepare students for employment upon graduation, or serve as prerequisite to a postsecondary program.

The community college can be more selective and establish stringent admission standards. This may be done by assessing applicants or by recruiting potential students who meet the established prerequisite requirements of the training. The program advisory committee can design a profile of the potentially successful student. The profile should contain a

list of qualities, traits and aptitudes that will indicate a higher potential for student success. Acceptable levels for these traits must also be determined. For example, the qualities deserving highest attention, mechanical ability and cognitive aptitude, are those which the educational program itself will not likely be able to influence, although these traits should have considerable weight in establishing the basic profile. Deficiencies in mathematical or communication skills may lend themselves to improvement through related instruction while the student is enrolled in the program. The following example illustrates specific qualities to consider when establishing the student profile:

Mechanic/Technician--Service

- Knowledge of basic tools and equipment used by mechanics/technicians
- Ability to analyze and solve mechanical and technical problems
- Ability to interpret written mechanical/technical materials
- Ability to interpret mechanical/technical drawings
- Mechanical dexterity

Mechanic/Technical Service Management

- Basic application of service
- Business skills
- Ability to work with people
- Communication skills
- Leadership

QUALIFYING AND PRETESTING

Assessing potential students for vocational programs is an integral part of the recruiting process since considerable amounts of time and money will be spent on students entering training. Recruiters must have a good idea of the candidate's basic aptitude. Whoever guides the candidate to the program needs to have knowledge of the student's interests, abilities and experience. These can be measured by a variety of assessment methods, which should be performed upon program entry. The assessment can help determine extent and level of training each individual should receive.

The minimim basic skills requirement for mathematics and language skills is specified on the curriculum framework. Assessment should determine the level at which the student can read, write, calculate mathematics and understand the English language. It is appropriate for the program advisory committee and the school to develop some selection criteria based on minimum skill levels. These criteria should remain flexible in order to maximize educational opportunity for all applicants. Additionally, vocational educators must make every effort to serve the variety of "special needs" students and to eliminate sex-bias and stereotyping in all occupational areas.

ADVISORY COMMITTEE

It is imperative that representatives of industry be organized into an advisory committee. Constantly changing technological demands of our society will continue to stimulate changing industrial patterns. Therefore, effective use of program advisory committees is vital to the successful implementation of vocational training programs. Advisory committees provide expert technical advice which is not easily obtainable elsewhere, offer external support of policies and have tremendous public relations potential.

The most effective advisory committees are those whose members have mutual respect for each other's abilities and vested interest in the training program because of their need for trained workers. The program advisory committee is also one of the most effective means of facilitating placement. Its role can be:

- To contact local industry and encourage them to use the school's placement office as a means of filling jobs
- To develop an effective procedure for interviewing and evaluating potential employees suggested by the school
- To assist in gathering accurate and current job information as it becomes available

COUNSELING AND GUIDANCE

Counseling of students serves two purposes. It guides the student into the program and it supports enrolled students on a continuing basis throughout the program. Much day-to-day counseling will be the responsibility of the teacher. The teacher has the most contact with the student and is in a position to detect and correct a problem. Each student will encounter new problems as the program develops. The teacher's job is to work with the student to help identify problems and then strive for solutions. The teacher will provide much of the counseling that focuses on trade knowledge and skills.

The professional counselor cannot be expected to have the subject matter expertise of the primary teacher. The counselor, however, can focus on the student's needs related to other issues such as personal growth, interests and attitudes. The ideal situation will provide at least one counselor with current knowledge of industry standards for career counseling. A useful tool which should be used in the counseling process is the Career Merit Achievement Plan (Career MAP) which presents minimum instructional content keyed to student performance standards. Career MAPs are available for each industrial program area, and can be used to document student achievement, isolate student interests, talents and weaknesses. They are also useful for placement purposes. Information on Career MAPs may be obtained by contacting the Department of Education, Division of Vocational, Adult, and Community Education, (904) 488-0484.

STUDENT PLACEMENT

Implementing an effective placement system is integral to developing a successful vocational training program. **S.B.E. Rule 229.551 (3)(g)** requires 70 percent placement of students who have completed a vocational training program. Although placement is not always a problem, as with students already working in a related occupation, the placement program should place emphasis upon students who are seeking entry-level employment since these students have little or no experience with industry.

The task of the placement program is to locate job openings in the community. The placement coordinator or teacher must know each student's personal aims and interests in addition to the information stated on the achievement record. In many cases, teachers are the best source to match students to job openings because of their contacts with the industry advisory committee. Input concerning employment openings must come from individual business establishments in the community. The placement coordinator should introduce a student to as many suitable job openings as possible. Conversely, employers can then be expected to interview as many qualified candidates as possible.

Cooperative Education

COOPERATIVE EDUCATION APPLICABILITY

Normally, a student will complete the entire program as a full-time student before obtaining employment as a commercial refrigeration technician. However, there may be situations where a student could be allowed to complete part of the program while employed as a commercial refrigeration technician. At this time it is appropriate for the student to enroll in industrial cooperative education (ICE). Guidelines for this training plan are provided in the "Industrial Cooperative Education Program Guide," published by the Division of Vocational, Adult, and Community Education,

Order # IE 508 BK 87.

Industrial cooperative education is a method of instruction designed to prepare students for jobs in the community. This method is a joint effort between the school and the business community. Student trainees receive a combination of instruction in the classroom and related on-the-job training through employment. Learning experiences are jointly planned and supervised by the teacher and the employer. Cooperative education is relevant to the needs of the student preparing for a work role, and will help the student to achieve success and personal satisfaction as the transition is made from school to the constantly changing world of work.

Cooperative education is defined in the Federal Register, Volume 39, number 143, Vocational Education, Section 102.96, as a program ". . . to prepare students for employment, through: (a) providing meaningful work experiences combined with formal education enabling students to acquire knowledge, skills, and appropriate attitudes, (b) removing the artificial barriers which separate work and education, (c) involving educators with employers, creating interaction whereby the needs and problems of both are made known, thereby making it possible for occupational curricula to be revised to reflect current needs in various occupations . . . ."

PURPOSE

Cooperative Education is for persons who, through written cooperative arrangements between the school and employers, receive instruction, including required academic courses and related instruction by alternation of study in school with a job in any industrial occupational field. These two experiences must be planned and supervised by the school and employers so that each contributes to the student's education and employability. Work periods and school attendance may be on alternative half days, full days, weeks or other periods of time to fulfill objectives of the cooperative education program.

GOALS AND OBJECTIVES

The primary goal of the cooperative method of vocational education is to prepare skilled, responsible individuals who can assume a productive role in the community. Specific objectives to meet the primary goal are:

- To prepare individuals for employment, adjustment and advancement in specified occupations or occupational areas (primary objective)
- To provide an understanding of the contribution of work to the social and economic welfare of our nation
- To provide students with an understanding and appreciation of the American free enterprise system
- To foster an awareness of the civic, social and moral responsibilities of individuals to society

- To stimulate students' interest in their chosen occupational fields and provide an understanding of the opportunities in each field
- To provide training that results in increased efficiency in performing job tasks
- To provide curriculum which is sensitive and adaptable to changes in occupational practices and procedures as they are affected by societal, economic, technical and educational developments
- To strive to develop a greater appreciation of the value of specifically trained personnel among employers, employees and consumers
- To reinforce skills learned in the school laboratory
- To provide experiences on tools and equipment not available in the school laboratory
- To supplement and broaden the school curriculum into areas not otherwise available

Student Organization Participation

Vocational student organizations operate pursuant to federal and state laws, which authorize them as viable components of vocational education programs. According to federal regulations, the vocational education program of instruction may include activities of vocational student organizations which are an integral part of the vocational instruction offered and which are supervised by vocational education personnel. The **S.B.E.** Rules authorize vocational student organizations as an integral part of the vocational education program as stated in **S.B.E. 6A-6.064 (7)** and **6A-6.065 (8).**

VOCATIONAL INDUSTRIAL CLUBS OF AMERICA (VICA)

VICA is an organization for secondary or postsecondary students enrolled in trade and industrial education programs in high schools, area vocational technical centers and junior and community colleges. It is the only national and international organization for trade and industrial students. The organization is designed to expand and enrich opportunities for leadership, social awareness and civic responsibility in vocational students.

Students who participate in VICA activities are often better prepared for the world of work. They acquire knowledge of the many opportunities

available in their chosen careers and become aware of the value of their contributions to society. They are also given opportunities to develop and utilize their talents and abilities in ways that otherwise would not be available to them.

BENEFITS OF VICA MEMBERSHIP FOR THE STUDENT

Membership in VICA offers the student the opportunity for growth and development in the following areas:

School and Community Service Activities Students in VICA become involved in various school and/or community services. These may include clothing or food collections for the needy, donation of time and service to the elderly and participation in fund raisers or similar activities.

Social Interaction with Fellow Students Activities are also available that offer students time for relaxation and fun. Social activities of this type may be held on a regular basis. They might be held on the school campus during school hours, or off campus after school. More formal functions would include end of the year award banquets or industry/employer appreciation dinner banquets.

Competition in Skill and Leadership Contests VICA offers various contests in all the skill and leadership areas it serves. Often, teachers identify talented students who represent their school in regional competitions. However, any student member of VICA may compete. Instructors should conduct planned contests within their trade areas. This also pertains to leadership areas. First and second place regional winners then move on to the state level contest. The state winners then compete at the national level of the United States Skill Olympics.

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INSTRUCTIONAL RESOURCES

STUDENT REFERENCE MATERIALS

Necessary instructional texts or pertinent material should be available for each student to satisfy training objectives. When textbooks are used, the copyright date should be as current as possible.

SERVICE MANUALS

Manuals with current manufacturer's service procedures and specifications should be available. These manuals must be located where students can use them while working in the shop area.

PERIODICALS

Current general and technical magazines and newspapers should be available for student and instructor use.

The following list of suggested resources is organized under each outcome shown in the curriculum framework. These resources have been recommended by instructors and program administrators.

01.0 DEMONSTRATE A BASIC UNDERSTANDING OF REFRIGERATION

TITLE, AUTHOR, ORDER# PUBLISHER		TYPE
Commercial Refrigeration Jim Doolin ISBN 0-914626-08-6	DOOLCO, INC.	text

02.0 DEMONSTRATE PROFICIENCY IN REFRIGERATION

TITLE, AUTHOR, ORDER# PUBLISHER	TYPE
NO ADDITIONAL RESOURCES HAVE BEEN SUGGESTED	

03.0 DEMONSTRATE A KNOWLEDGE OF REFRIGERATION-SERVICING AND TESTING EQUIPMENT

TITLE, AUTHOR, ORDER# PUBLISHER	TYPE
NO ADDITIONAL RESOURCES HAVE BEEN SUGGESTED	

04.0 DEMONSTRATE PROFICIENCY IN REFRIGERATION-PIPING

TITLE, AUTHOR, ORDER# PUBLISHER		TYPE
Good Piping Practice	EMHART INDUSTRIES, INC.	program

05.0 DEMONSTRATE PROFICIENCY IN REFRIGERATION-PIPE SIZING AND TROUBLESHOOTING

TITLE, AUTHOR, ORDER#	PUBLISHER	TYPE
NO ADDITIONAL RESOURCES HAVE BEEN SUGGESTED		

06.0 DEMONSTRATE PROFICIENCY IN BASIC ELECTRICITY

TITLE, AUTHOR, ORDER#	PUBLISHER	TYPE
Basic Electricity	BERGWALL PRODUCTIONS	video series

07.0 DEMONSTRATE PROFICIENCY IN ELECTRICAL GENERATION AND DISTRIBUTION

TITLE, AUTHOR, ORDER#	PUBLISHER	TYPE
NO ADDITIONAL RESOURCES HAVE BEEN SUGGESTED		

08.0 DEMONSTRATE PROFICIENCY IN ELECTRICAL COMPONENTS/MOTORS

TITLE, AUTHOR, ORDER#	PUBLISHER	TYPE
NO ADDITIONAL RESOURCES HAVE BEEN SUGGESTED		

09.0 DEMONSTRATE PROFICIENCY IN SOLID STATE ELECTRONICS

TITLE, AUTHOR, ORDER#	PUBLISHER	TYPE
Solid State Low Pressure Control	EMHART INDUSTRIES, INC.	program

10.0 DEMONSTRATE PROFICIENCY IN COMMERCIAL AND ENGINEERED CONTROL SYSTEMS

TITLE, AUTHOR, ORDER#	PUBLISHER	TYPE

NO ADDITIONAL RESOURCES HAVE BEEN SUGGESTED

11.0 DEMONSTRATE AN UNDERSTANDING OF REFRIGERATION LOAD

TITLE, AUTHOR, ORDER#	PUBLISHER	TYPE

NO ADDITIONAL RESOURCES HAVE BEEN SUGGESTED

12.0 DEMONSTRATE PROFICIENCY IN PSYCHROMETRICS

TITLE, AUTHOR, ORDER#	PUBLISHER	TYPE

NO ADDITIONAL RESOURCES HAVE BEEN SUGGESTED

13.0 DEMONSTRATE PROFICIENCY IN METERING DEVICES

TITLE, AUTHOR, ORDER#	PUBLISHER	TYPE
Adjustment of the Thermostatic Expansion Valve	EMHART INDUSTRIES, INC.	program

14.0 DEMONSTRATE PROFICIENCY IN COMPRESSORS

TITLE, AUTHOR, ORDER#	PUBLISHER	TYPE
Compressor, Maintenance and Service	EMHART INDUSTRIES, INC.	program

15.0 DEMONSTRATE PROFICIENCY IN CONDENSERS

TITLE, AUTHOR, ORDER# PUBLISHER TYPE

NO ADDITIONAL RESOURCES HAVE BEEN SUGGESTED

16.0 DEMONSTRATE PROFICIENCY IN EVAPORATORS

TITLE, AUTHOR, ORDER# PUBLISHER TYPE

NO ADDITIONAL RESOURCES HAVE BEEN SUGGESTED

17.0 DEMONSTRATE AN UNDERSTANDING OF ACCESSORIES

TITLE, AUTHOR, ORDER# PUBLISHER TYPE

NO ADDITIONAL RESOURCES HAVE BEEN SUGGESTED

18.0 DEMONSTRATE AN UNDERSTANDING OF COMMERCIAL REFRIGERATION-SYSTEM APPLICATION

TITLE, AUTHOR, ORDER#	PUBLISHER	TYPE

NO ADDITIONAL RESOURCES HAVE BEEN SUGGESTED

19.0 DEMONSTRATE AN UNDERSTANDING OF REFRIGERATED STORAGE SYSTEMS

TITLE, AUTHOR, ORDER#	PUBLISHER	TYPE

NO ADDITIONAL RESOURCES HAVE BEEN SUGGESTED

20.0 DIAGNOSE AND REPAIR ICE MACHINES

TITLE, AUTHOR, ORDER#	PUBLISHER	TYPE
Water Story	THE MANITOWOC CO., INC.	video

PUBLISHERS' ADDRESSES

BERGWALL PRODUCTIONS
P.O. Box 238
Garden City, NY 11530

DOOLCO, INC.
11252 Goodnight Lane, Suite 600
Dallas, TX

EMHART INDUSTRIES, INC.
360 Pennington Avenue
Trenton, NJ 08601

THE MANITOWOC., INC.
P.O. Box 707
Manitowoc, WI 54220

FACILITIES

Facility Design Recommendations

Facilities, tools and equipment are essential parts of training programs, and must be designed to meet State program standard requirements and instructional objectives. This section of the Program Guide contains information for setting up classroom and laboratory facilities. Facility design criteria and space requirements are specified in **S.B.E. Section B, Chapter 6A-2**.

TEACHING FACILITIES

The instructional environment should duplicate, as closely as possible, the real-life work environment the student will enter after graduation. The more the school resembles the industrial environment, the easier it will be for the student to make the transition from school to work. Tools, supplies and equipment should conform to local industry standards. The teacher should actively pursue supplemental resources to expose the students to state-of-the-art equipment.

All facilities should include classroom space, as well as space for regular classroom equipment such as audio-visual equipment. Laboratory facilities should be equipped with work stations or workbenches, tables, chairs and special training aids to demonstrate basic principles and theory. They should contain enough tools and equipment to enable several students to work individually on the same learning activity.

UPDATING FACILITIES

To keep pace with technological changes and improvements, facilities must be updated on a continuing basis. When planning facilities, priority must be to provide space which will fulfill changing needs of the instructional program. Buildings should be designed with flexibility to expand in order to accommodate future program changes and to allow for greater ease of facility updating. The program advisory committee should be used to assist the school in establishing priorities for obtaining facilities, tools and equipment. Careful planning and analysis of current and future needs will lead to the establishment of an effective training environment.

SCHOOL FACILITIES

Commercial Refrigeration Technology

This section of the program guide provides guidelines for Commercial Refrigeration program facilities. All vocational programs must meet additional facility requirements specified in **S.B.E. Section B, Chapter 6 A-2.**

The classroom/laboratory areas should be designed to accommodate oversized machinery, equipment, materials and holding tables. Each area should be equipped with special lighting, as necessary. The area should provide oversized openings equipped with service entry doors to the movement and transporting of oversized equipment, materials and products.

The laboratory should include electrical outlets providing 110 volts at each work station. Electrical outlets should be permanently mounted to the work station benches. Additional electrical outlets should be installed along the walls and in the center areas of the laboratory. Electrical outlets in the center areas should be mounted on posts between the ceiling and work stations or on pull down extension systems. Special electrical wiring may be required to supply the power requirements of specialized equipment. All electrical service must be installed according to local building code requirements.

CLASSROOM/LABORATORY FACILITIES

Space requirements for **new** facility construction for this program are specified in **S.B.E. Rule 6A-2.032** as shown below.

NEW FACILITIES
COMMERCIAL REFRIGERATION TECHNOLOGY

Occupant Design Stations	20
Net Square Feet Per Occupant	
Minimum	135
Normal	143
Maximum	150
Total Net Square Feet	
Minimum	2700
Normal	2860
Maximum	3000

WORK STATION ARRANGEMENT

The arrangement of work stations and specialized equipment depends upon the general layout of the facilities, but careful consideration must be given to convenience to entrances and exits, easy movement among work stations and tool/storage areas. The area should have a counter convenient to work stations. Overall layout of the facility should be planned so that the location of entrances and exits permits a logical flow of work in progress. One of the most critical factors in planning a facility is the arrangement of work stations to obtain a safe, efficient traffic pattern.

ADDITIONAL FACILITY CONSIDERATIONS

Training Stations

Training stations and live work areas must be available in the type and number required to meet program goals and performance objectives.

Instructional Area

A classroom or designated area of the laboratory should be available for lecture, instruction, viewing audio visual materials and other nonshop activities.

Personal Tool/Equipment Storage Area

A secure storage room or area should be provided, with enough shelf space for student supplies/tool boxes and floor space for equipment.

General Storage

Storage areas for tools, parts, supplies and machines must be sufficient to support the activities outlined in the program goals and performance objectives.

Office Space

An area separate from the classroom and laboratory should be available and convenient for use by the instructor(s) as an office.

Maintenance

A regular facilities maintenance program must be implemented to ensure that equipment and facilities are safe and usable to meet instructional needs.

Housekeeping

The classroom, laboratory and support area(s) must be kept clean and orderly.

Ventilation

A fume/dust removal system should be in place and operable. When appropriate, heating and cooling systems should be used to provide sufficient comfort for learning. Ventilation requirements are stated in **S.B.E. Rule 6A-2.066**.

First Aid

A first aid station must be in place, well marked and complete with appropriate supplies.

Support Facilities

Restrooms, clean-up areas and lockers convenient to the shop should be available for students.

Safety

The facilities must meet all Occupational Safety and Health Administration (OSHA) safety standards, where applicable.

Facility Evaluation

The program advisory committee should be asked to conduct an annual evaluation of the facilities to insure the program's continuing capability to meet instructional objectives.

Safety, Maintenance and Liability

SAFETY

S.B.E. Rule 6A-2.097

The Florida State Board of Education establishes rules for the operation of public schools. **Part III, Section B, Chapter 6A-2** of the State Board of Education Rules contains the standards for existing educational facilities. Subsections deal with the entire school facility in regard to such topics as electrical equipment, flammable materials, ventilation, fire safety, storage and illumination. Subsection 6A-2.097 contains safety regulations pertaining to vocational classes.

The statute requires 100 percent protection of every student and teacher participating in laboratory work wherein the type of activities listed in the statute above are conducted. This will include: demonstration by teachers or students, students and teachers present in a room or laboratory when students are engaged in make-up work or project work, and when anyone is using tools for construction or repair work involving the shaping or cutting of any solid materials.

Rules and regulations for an eye protection program should be organized and distributed to teachers, students and school personnel. Safety devices should be worn by those participating in the activity and by those who are observers or who may be in close proximity.

Marking of Hazardous Areas

Floors, walls, posts, stationary objects, machinery and equipment should be properly painted, marked, coded or identified, according to recommended safety practices of OSHA, the school board and industry.

Emergency Procedure For Injuries

The following procedures are recommended in the event of an injury or sudden illness in a student:

- Refer to the red "fire or medical emergency" signs posted in appropriate areas.
- Provide immediate first aid if so qualified.
- Notify appropriate personnel to advise them of the problem. They can also contact emergency trained personnel on campus.
- A conscious person has the right to refuse treatment and/or transportation to a medical facility.
- Advise students that they will be financially responsible for ambulance and emergency care.
- The paramedics will assume patient care upon arrival.
- If emergency transportation is not indicated, the student may spend time at the clinic, be allowed to go home or go to a medical facility.
- Be sure to complete the appropriate student injury form for any and all accidents or sudden illness.

MAINTENANCE

Schools should have the necessary facilities for routine maintenance. Special maintenance requirements for this program concern the hand and power tools and machines. Arrangements must be made to accomplish routine and non-routine maintenance of hand and power tools and cutting and shaping machines. Arrangements can be made through the school's shop or an outside agency.

VOCATIONAL TEACHER LIABILITY

Liability of Teacher and School Board

Negligence of vocational education teachers can cause unnecessary injury, and may result in teacher and school district liability. Vocational teachers are recommended to carry personal liability insurance. To reduce the risk of liability and injuries, the following suggestions are provided.

- Follow accepted policies of the school board.
- Do not allow students to use equipment or tools which have not been approved by the administration and Board of Education.
- Establish safety rules and enforce them.
- Do not leave the shop/laboratory while students are working.
- Do not permit non-enrolled students to use the shop/laboratory.
- Do not allow students to use machines or tools for which instruction has not been given.
- Do not approve unsupervised student activities inside or outside the shop/laboratory.
- Prepare accident forms for all accidents.
- Regularly inspect the workplace and equipment for defects or potential hazards and maintain documentation of unserviceable or hazardous items.
- Consider age, maturity, skill and ability of students when providing instruction and supervision.
- Administer safety tests to students upon completion of the demonstration of a specific machine, tool or process and keep documentation on file in your office.
- Require all students to wear eye protection devices, when appropriate, for laboratory activities.

SUGGESTED EQUIPMENT LIST

General Classroom Equipment

DESCRIPTION

Chalkboard

Bulletin board

Bookcases

Cabinet-storage

Student study stations

Audio-visual equipment as needed

Laboratory Tools and Equipment

These tools and items of equipment are normally used in this program. Equipment items are listed under each outcome, corresponding to the curriculum framework. Consumable supplies should be readily available to assure continuous instruction. Consumable supplies such as solder and wire are not contained in the equipment list.

Commercial Refrigeration Technology is a specialization program to follow Air Conditioning, Refrigeration and Heating Technology which is the CORE program. Equipment used in the CORE program is presumed, therefore only additional equipment is listed here.

01.0 DEMONSTRATE A BASIC UNDERSTANDING OF REFRIGERATION

DESCRIPTION

Basic walk-in cooler with water cooled condenser
Walk-in freezer with air cooled condenser

02.0 DEMONSTRATE PROFICIENCY IN REFRIGERATION CYCLE/DIAGRAMS

DESCRIPTION

NO ADDITIONAL EQUIPMENT HAS BEEN SUGGESTED

03.0 DEMONSTRATE A KNOWLEDGE OF REFRIGERATION-SERVICING AND TESTING EQUIPMENT

DESCRIPTION

NO ADDITIONAL EQUIPMENT HAS BEEN SUGGESTED

04.0 DEMONSTRATE PROFICIENCY IN REFRIGERATION-PIPING MATERIALS AND FABRICATION

DESCRIPTION

NO ADDITIONAL EQUIPMENT HAS BEEN SUGGESTED

05.0 DEMONSTRATE PROFICIENCY IN REFRIGERATION PIPE SIZING AND TROUBLESHOOTING

DESCRIPTION

NO ADDITIONAL EQUIPMENT HAS BEEN SUGGESTED

06.0 DEMONSTRATE PROFICIENCY IN BASIC ELECTRICITY

DESCRIPTION

NO ADDITIONAL EQUIPMENT HAS BEEN SUGGESTED

07.0 DEMONSTRATE PROFICIENCY IN ELECTRICAL GENERATION DISTRIBUTION

DESCRIPTION

NO ADDITIONAL EQUIPMENT HAS BEEN SUGGESTED

08.0 DEMONSTRATE PROFICIENCY IN ELECTRICAL COMPONENTS/MOTORS

DESCRIPTION

Motor trainer, 10 PSC
Motor trainer, 10 potential relay
Motor trainer, 10 shaded pole
Motor trainer, 30

09.0 DEMONSTRATE PROFICIENCY IN SOLID STATE ELECTRONICS

DESCRIPTION

NO ADDITIONAL EQUIPMENT HAS BEEN SUGGESTED

10.0 DEMONSTRATE PROFICIENCY ON COMMERCIAL AND ENGINEERED CONTROL SYSTEMS.

DESCRIPTION

NO ADDITIONAL EQUIPMENT HAS BEEN SUGGESTED

11.0 DEMONSTRATE AN UNDERSTANDING OF REFRIGERATION LOAD

DESCRIPTION

NO ADDITIONAL EQUIPMENT HAS BEEN SUGGESTED

12.0 DEMONSTRATE PROFICIENCY IN PSYCHROMETRICS

DESCRIPTION

NO ADDITIONAL EQUIPMENT HAS BEEN SUGGESTED

13.0 DEMONSTRATE PROFICIENCY IN METERING DEVICES

DESCRIPTION

NO ADDITIONAL EQUIPMENT HAS BEEN SUGGESTED

14.0 DEMONSTRATE PROFICIENCY IN COMPRESSORS

DESCRIPTION

Hermetic compressor cut-away
Scroll compressor cut-away

15.0 DEMONSTRATE PROFICIENCY IN CONDENSERS

DESCRIPTION

NO ADDITIONAL EQUIPMENT HAS BEEN SUGGESTED

16.0 DEMONSTRATE PROFICIENCY IN EVAPORATORS

DESCRIPTION

NO ADDITIONAL EQUIPMENT HAS BEEN SUGGESTED

17.0 DEMONSTRATE AN UNDERSTANDING OF ACCESSORIES

DESCRIPTION

NO ADDITIONAL EQUIPMENT HAS BEEN SUGGESTED

18.0 DEMONSTRATE AN UNDERSTANDING OF COMMERCIAL REFRIGERATION-SYSTEM APPLICATION

DESCRIPTION

NO ADDITIONAL EQUIPMENT HAS BEEN SUGGESTED

19.0 DEMONSTRATE AN UNDERSTANDING OF REFRIGERATED STORAGE SYSTEMS

DESCRIPTION

Lo temp condensing unit
Low temp evaporation coil
Medium temp condensing unit
Medium temp evaporation coil
Various flow controls

20.0 DIAGNOSE AND REPAIR ICE MACHINES

DESCRIPTION

Assorted ice machines

PROFESSIONAL DEVELOPMENT

Teacher Technical Updating

Technical updating workshops are scheduled periodically throughout the State, usually in the summer months. Teachers should take advantage of the opportunity to attend the Commercial Refrigeration program technical update workshops when they are held. All instructional staff are encouraged to participate in as many training opportunities as possible.

Teachers should seek opportunities with local companies to maintain currency with industry trends. During periods when school is not in session, teachers are encouraged to make arrangements to return to industry for suitable involvement in their area of expertise.

Membership in professional associations offers vocational educators an enormous range of opportunities for working together to strengthen the field and to develop personal competence and satisfaction in work. The associations have similar goals and activities. They seek excellence in program content by means of joint efforts among members, communications that keep members current, forums for the discussion of issues in the field, useful and stimulating publications and sound professional growth experiences at local, state, regional and national meetings and annual conventions. They are concerned with increasing public understanding and support of the field. Teachers are encouraged to maintain affiliation with professional organizations. A list of professional organizations follows this section of the guide.

Teacher Standards

As a prerequisite to certification, teachers must have the required years of experience in the appropriate technical field as defined in the certification standards. For the Commercial Refrigeration Technology program, the requirements are six years continuous experience in commercial refrigeration. The teacher is then judged qualified to teach upon meeting one of the following criteria: (1) regular or temporary Florida teacher's certificate with appropriate coverage, (2) Approval of local school board consistent with adopted school policy or (3) regular or temporary Florida teacher's certificate with other than appropriate coverage (has met all occupational experience requirements prescribed as a prerequisite to appropriate certification and has been approved by the school board to teach

out-of-field). Refer to the Curriculum Framework for this program to determine the appropriate occupational specialization coverage required for certification.

Instructional staff must have technical competency and meet all State and local requirements for certification. Instructors should hold current, nationally recognized certification in the subject areas taught, if awarded. Beginning teachers must be enrolled in the State Beginning Teacher Program.

A systematic method of obtaining "substitute" instructors, approved by the school board, should be used to assure instructional continuity. An orientation session for substitutes should be held on a regular basis. The substitute should be a competent instructor in the occupational area and specific competencies taught.

Professional Organizations and Support Services

EDUCATION ORGANIZATIONS

AMERICAN VOCATIONAL ASSOCIATION (AVA)
1410 King Street
Alexandria, VA 22314
800-826-9972

FLORIDA ASSOCIATION FOR TRADE AND INDUSTRIAL EDUCATION, INC. (FATIE)
Florida Department of Education
Industrial Education - Vocational Division
Knott Building
Tallahassee, FL 32399
904-488-0484

FLORIDA VOCATIONAL ASSOCIATION (FVA)
1420 North Paul Russell Road
Tallahassee, FL 32399
904-878-6860

FLORIDA VOCATIONAL INDUSTRIAL CLUBS OF AMERICA (VICA)
Florida Department of Education
Knott Building
Tallahassee, FL 32399
904-488-0484

TRADE ORGANIZATIONS

This list contains trade associations and technical societies. Many offer training programs of some sort, either directly or through their member companies. Specific details should be requested in writing.

AIR CONDITIONING CONTRACTORS OF AMERICA
1513 16th Street NW
Washington, D.C. 20036-1405

AIR CONDITIONING & REFRIGERATION INSTITUTE
1501 Wilson Boulevard, Suite 600
Arlington, VA 22209-2403

AMERICAN SOCIETY OF HEAT, REFRIGERATION, AND AIR CONDITIONING ENGINEERS (ASHRAE)
1791 Tulie Circle NE
Atlanta, GA 30329-2398

REFRIGERATION SERVICE ENGINEERS SOCIETY (RSES)
1666 Rand Road
Des Plains, IL 60016-3552

SHEET METAL, AIR CONDITIONING CONTRACTORS NATIONAL ASSOCIATION
8224 Old Courthouse Road

IE 582 BK-93

CAREER MERIT ACHIEVEMENT PLAN (CAREER MAP)

COMMERCIAL REFRIGERATION TECHNOLOGY

(0647.023100)

STUDENT'S NAME

State of Florida

An affirmative action/equal opportunity employer

DEPARTMENT OF EDUCATION
Betty Castor, Commissioner of Education

DIVISION OF VOCATIONAL, ADULT AND COMMUNITY EDUCATION
Lanny Larson, Director

DEVELOPED BY:
University of South Florida
Department of Adult and Vocational Education

INDUSTRY-BASED PARTNERSHIP PROGRAMS: The State of Florida is committed to the development of industry-based partnership programs, designed by education and industry to respond to industry's demand for a highly skilled work force.

ACKNOWLEDGEMENTS

PARTNERSHIP WITH INDUSTRY

The following industry representatives are recognized, in addition to original industry members, for their valuable contributions to the identification and validation of the Commercial Refrigeration competencies reflected in this MAP:

Ralph Bollinger, Energy Conservation Unlimited
Bob Fair, Fair & Son, Inc.

To order more copies of this document
call 1-800-342-9271

If you have questions regarding program content,
please contact:

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Division of Vocational Adult and Community Education
Florida Department of Education
Florida Education Center
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Suncom 278-1147

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THIS MERIT ACHIEVEMENT PLAN RECORDS THE COMMERCIAL REFRIGERATION ACHIEVEMENTS OF:

Student's Name _____

Student ID Number _____

Student's Address _____

_____

Initial Instructor _____

School _____

Date Started _____

PRIMARY JOB TITLE(S) FOR COMMERCIAL REFRIGERATION

- None determined at the time.

Program completers qualify for the primary job title(s) listed above. Related job titles may be added based on those job titles found in industry and/or the Dictionary of Occupational Titles.

OVERVIEW

This Career MAP includes the competencies required for entry into the field of commercial refrigeration. Business and industry representatives have recommended that students in this field master these competencies in order to become employable. Local education agencies (LEAs) may adapt these competencies to meet their workforce needs.

PURPOSE OF THE MAP

The purposes of the MAP are: to display the student performance standards (SPS) required by the LEA and to document the level of achievement on student performance standards that the student demonstrates.

HOW TO USE THE MAP

Administrator and Instructor. The administrator and instructor can use Career MAPs in curriculum planning, program updating and improvement and teacher recruitment, selection and updating. If the LEA changes or adds student performance standards, the revised or additional student performance standards should be included in the blank boxes that appear within each intended outcome or at the end of this MAP.

Instructor. The instructor can use Career MAPs to keep track of student progress on student performance standards. By periodically reviewing the ratings on student performance standards, the instructor can identify a student's strengths and weaknesses and, on that basis, identify the skills for which the student needs remedial instruction or advanced training. The MAP can also be useful in student counseling and evaluation.

Co-op Instructor/Employer. The employer who sponsors a co-op program should use the Career MAP for keeping a record of the student's performance on appropriate standards. The MAPs will also help the co-op instructor/employer in counseling and evaluating the student.

Student. The student may use the MAP to show potential employers the performance standards he or she has mastered. In order to present a complete record, the student should encourage the instructor/co-op employer to rate his or her level of achievement on all the appropriate student performance standards and to fill in the verification form/cooperative work experience page in the back of this MAP.

Employer. The MAP shows an employer the student performance standards mastered by the student (a prospective employee) and the proficiency level achieved on each student performance standard. This information can help the employer make decisions about hiring, job assignments and job-training needs.

RATING STUDENT PERFORMANCE STANDARDS

Performance Competencies. Ratings on student performance standards should be based upon business/industrial performance standards. The evaluator observes and evaluates student performance as he or she would in the role of the employer or supervisor.

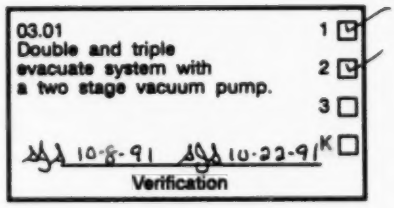
For each skill listed the learner receives a rating of 1, 2 or 3. Each rating indicates a particular level of achievement:

1 = Learner demonstrates knowledge and understanding of this student performance standard, but is not yet able to apply that knowledge or understanding.

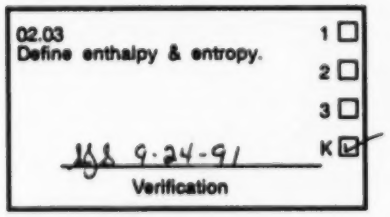
2 = Learner performs this student performance standard satisfactorily with only periodic supervision.

3 = Learner performs this student performance standard satisfactorily without supervision.

Whenever a performance standard is demonstrated, the instructor checks the appropriate rating box (1, 2 or 3) and initials and dates the verification line. If the student later demonstrates a higher level of achievement on a performance competency, the instructor checks the higher level and then enters his or her initials and the new date on the verification line, as shown in the following example:



Knowledge Competencies. For each SPS that is a knowledge competency only, with no manipulative skill involved, only one level of achievement is possible. If the student masters the competency, he or she receives a check in the bottom box ("K"), as shown below:



NOTE: A student performance standard without a checked rating indicates that the learner has not mastered the standard from lack of either ability, time, opportunity or need (the student's area of specialization may not have required it).

5.1

01.0 DEMONSTRATE A BASIC UNDERSTANDING OF REFRIGERATION.

01.01 Demonstrate a basic understanding & appreciation of air conditioning & its impact on society. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification
1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification

02.0 DEMONSTRATE PROFICIENCY IN REFRIGERATION CYCLE/DIAGRAMS.

02.01 Identify all zones & lines on the pressure enthalpy (PH) chart. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	02.02 State the unit of measurement for H (Btu/lb) on the pressure enthalpy (PH) chart. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	02.03 Define enthalpy & entropy. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification
02.04 Diagram a simple cycle using the pressure enthalpy (PH) chart. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	02.05 Show arrows for direction of cycle on the (PH) chart. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	02.06 Calculate qe on the (PH) chart. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification
02.07 Calculate qw on the (PH) chart. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	02.08 Calculate qc on the (PH) chart. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification
1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification

03.0 DEMONSTRATE A KNOWLEDGE OF REFRIGERATION-SERVICING AND TESTING EQUIPMENT.

03.01 Double & triple evacuate system with a two stage vacuum pump. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	03.02 Properly use a micron gauge. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	03.03 Properly use a mercury U-tube. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification
1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification

04.0 DEMONSTRATE PROFICIENCY IN REFRIGERATION-PIPING MATERIALS & FABRICATION.

04.01 Describe procedures used to protect valves/fittings from heat damage. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	04.02 Describe the applications of vibration eliminators. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	04.03 Identify & select correct insulation for application. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification
1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification

05.0 DEMONSTRATE PROFICIENCY IN REFRIGERATION-PIPE SIZING & TROUBLESHOOTING.

05.01 Determine capacities of refrigerant lines. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	05.02 Determine equivalent lengths of fittings. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	05.03 Calculate total effective length of pipe run. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification

05.04 Calculate amount of refrigerant in lines. 1 2 3 K Verification	05.05 Describe use of traps in suction risers. 1 2 3 K Verification	05.06 Explain pressure drop. 1 2 3 K Verification
05.07 Explain saturation temperature drop. 1 2 3 K Verification	05.08 Calculate pressure drop in liquid line risers. 1 2 3 K Verification	05.09 Size double risers. 1 2 3 K Verification
05.10 Size hot gas line. 1 2 3 K Verification	05.11 Size liquid line from condenser to receiver. 1 2 3 K Verification	1 2 3 K Verification
1 2 3 K Verification	1 2 3 K Verification	1 2 3 K Verification

06.0 DEMONSTRATE PROFICIENCY IN BASIC ELECTRICITY.

06.01 Define & compare single & multi phase voltage & current. 1 2 3 K Verification	06.02 Use Ohm's law to calculate various circuit quantities. 1 2 3 K Verification	06.03 Calculate electrical circuit loads. 1 2 3 K Verification
06.04 Interpret tables & charts from National Electrical Code (NEC). 1 2 3 K Verification	1 2 3 K Verification	1 2 3 K Verification
1 2 3 K Verification	1 2 3 K Verification	1 2 3 K Verification

07.0 DEMONSTRATE PROFICIENCY IN ELECTRICAL GENERATION AND DISTRIBUTION.

07.01 Demonstrate the ability to figure wire sizes & voltage drop. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	07.02 Draw & identify power transformer types. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	07.03 Size & test fuses & breakers & safely replace them. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification
1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification

08.0 DEMONSTRATE PROFICIENCY IN ELECTRICAL COMPONENTS/MOTORS.

08.01 Define electromotive force, counter electromotive, torque & rotation. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	08.02 Explain the operation & application of a three phase motor. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	08.03 Explain the operation & application of shaded pole. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification
08.04 Explain the operation & application of permanent split capacitor. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	08.05 Demonstrate proper use of testing equipment for motors. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	08.06 Describe lubrication methods for motors. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification
1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification
1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification

09.0 DEMONSTRATE PROFICIENCY IN SOLID STATE ELECTRONICS.

09.01 Explain basic solid state circuits. 1 2 3 K Verification	09.01 Identify, test, & replace circuit boards. 1 2 3 K Verification	1 2 3 K Verification
1 2 3 K Verification	1 2 3 K Verification	1 2 3 K Verification

10.0 DEMONSTRATE PROFICIENCY IN COMMERCIAL AND ENGINEERED CONTROL SYSTEMS.

10.01 Identify electromechanical control systems. 1 2 3 K Verification	10.02 Identify electronic control systems. 1 2 3 K Verification	10.03 Identify programmable control systems. 1 2 3 K Verification
10.04 Describe sequences of operation of types of control systems. 1 2 3 K Verification	1 2 3 K Verification	1 2 3 K Verification
1 2 3 K Verification	1 2 3 K Verification	1 2 3 K Verification
1 2 3 K Verification	1 2 3 K Verification	1 2 3 K Verification

11.0 DEMONSTRATE AN UNDERSTANDING OF REFRIGERATION LOAD.

11.01 Define "U" value (BTu/hr. ft2-F). 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	11.02 Define "K" value (Fft2 hr. /BTu). 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	11.03 Define "C" value (Fft2 hr. /BTu). 1 ☐ 2 ☐ 3 ☐ K ☐ Verification
11.04 Define "R" value (Fft2 hr./ BTu). 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	11.05 Interpret heat transfer tables ("U, K, C, R"). 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	11.06 Calculate total heat transfer value of any surface (R) - (U). 1 ☐ 2 ☐ 3 ☐ K ☐ Verification
11.07 Explain conduction heat load source. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	11.08 Explain infiltration as a heat load source. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	11.09 Explain product heat load source. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification
11.10 Explain misc. loads (people, motors, equipment) as heat sources. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	11.11 Explain the purpose of vapor barriers. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	11.12 Interpret tables of specific heat values, latent heat & heat of respiration. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification
1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification

12.0 DEMONSTRATE PROFICIENCY IN PSYCHROMETRICS.

12.01 Identify the dry bulb line (DB). 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	12.02 Identify the wet bulb line (WB). 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	12.03 Identify relative humidity (RH). 1 ☐ 2 ☐ 3 ☐ K ☐ Verification

12.04 Identify dew point (DP). 1 2 3 K Verification	12.05 Identify enthalpy (h). 1 2 3 K Verification	12.06 Identify specific humidity (grains of moisture) or (Lbw/Lbda). 1 2 3 K Verification
12.07 Calculate refrigeration sensible heat ratio. 1 2 3 K Verification	1 2 3 K Verification	1 2 3 K Verification
1 2 3 K Verification	1 2 3 K Verification	1 2 3 K Verification

13.0 DEMONSTRATE PROFICIENCY IN METERING DEVICES.

13.01 Define AEV. 1 2 3 K Verification	13.02 Define low side float. 1 2 3 K Verification	13.03 Define high side float. 1 2 3 K Verification
13.04 Define hand expansion valve. 1 2 3 K Verification	13.05 Evaluate system performance when using different types of flow control devices. 1 2 3 K Verification	1 2 3 K Verification
1 2 3 K Verification	1 2 3 K Verification	1 2 3 K Verification
1 2 3 K Verification	1 2 3 K Verification	1 2 3 K Verification

14.0 DEMONSTRATE PROFICIENCY IN COMPRESSORS

14.01 Describe screw methods of compression. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	14.02 Describe scroll methods of compression. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	14.03 Select the correct compressor based on cooling load. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification
14.04 Describe the operation of reciprocating compressors. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	14.05 Describe lubrication methods for compressors. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	14.06 Describe the methods of compressor unloading. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification
1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification

15.0 DEMONSTRATE PROFICIENCY IN CONDENSERS.

15.01 Identify & describe evaporative condenser. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	15.02 Determine proper air & water flow. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	15.03 Adjust the air flow for proper temperature difference. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification
15.04 Adjust water flow for proper GPM & temperature difference. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification
1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification

16.0 DEMONSTRATE PROFICIENCY IN EVAPORATORS.

16.01 Identify & explain the operation of the different types of evaporator coils. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification
1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification

17.0 DEMONSTRATE AN UNDERSTANDING OF ACCESSORIES.

17.01 Identify the proper location of accumulators. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	17.02 Identify the proper location of suction filters. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	17.03 Identify the proper location of oil separators. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification
17.04 Identify the proper location of head pressure controls. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	17.05 Identify the proper location of solenoid valves. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	17.06 Identify the proper location of evaporator pressure regulating valve. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification
17.07 Identify the proper location of crankcase regulating valves. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	17.08 Identify the proper location of heat exchangers. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	17.09 Identify types & location of freeze protection. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification
1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification

18.0 DEMONSTRATE AN UNDERSTANDING OF COMMERCIAL REFRIGERATION-SYSTEM APPLICATION.

18.01 Explain the operation of a single compressor/ evaporator system. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	18.02 Explain the multiplex system. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	18.03 Explain the cascade system. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification
18.04 Explain how to set superheat on a multiplex system. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	18.05 Explain the heat reclaim cycle (Three way value). 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	18.06 Explain the head pressure control system (flooded condenser). 1 ☐ 2 ☐ 3 ☐ K ☐ Verification
18.07 Adjust EPR value. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	18.08 Check the suction stop valve. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	18.09 Check system for full refrigerant charge. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification
18.10 Charge system with refrigerant on liquid side as well as suction side. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	18.11 Adjust all operating & safety controls. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	18.12 Replace filter driers. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification
18.13 Check oil. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	18.14 Change oil. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification
1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification
1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification

19.0 DEMONSTRATE AN UNDERSTANDING OF REFRIGERATED STORAGE SYSTEMS.

19.01 Explain the difference between medium temperature, low temperature, & ultra low temperature storage systems. 1 2 3 K Verification	19.02 Identify service cases & self-service cases. 1 2 3 K Verification	19.03 Explain the difference between service cases & self-service cases. 1 2 3 K Verification
19.04 Explain the operation of air screen freezers. 1 2 3 K Verification	19.05 Explain the operation of glass door freezers. 1 2 3 K Verification	19.06 Explain the operation of coffin cases. 1 2 3 K Verification
19.07 Explain the electrical resistance method of defrost. 1 2 3 K Verification	19.08 Explain the hot gas method of defrost. 1 2 3 K Verification	19.09 Explain the cool gas method of defrost. 1 2 3 K Verification
19.10 Replace anti sweat heaters. 1 2 3 K Verification	19.11 Replace fan motors & fans. 1 2 3 K Verification	19.12 Check and/or replace fan delay. 1 2 3 K Verification
19.13 Measure & verify air flow. 1 2 3 K Verification	19.14 Clean drain line. 1 2 3 K Verification	1 2 3 K Verification
1 2 3 K Verification	1 2 3 K Verification	1 2 3 K Verification
1 2 3 K Verification	1 2 3 K Verification	1 2 3 K Verification

20.0 DIAGNOSE AND REPAIR ICE MACHINES.

20.01 Explain the operation of ice making. 1 2 3 K Verification	20.02 Follow manufacturer's instructions for cleaning the evaporator. 1 2 3 K Verification	20.03 Clean the condenser. 1 2 3 K Verification
20.04 Check the harvest cycle. 1 2 3 K Verification	20.05 Adjust cube size. 1 2 3 K Verification	20.06 Check metering device for proper operation. 1 2 3 K Verification
20.07 Check grid heaters when applicable. 1 2 3 K Verification	20.08 Clean ice storage area. 1 2 3 K Verification	20.09 Replace bearings in flake type machine. 1 2 3 K Verification
20.10 Check water level. 1 2 3 K Verification	20.11 Check water pressure. 1 2 3 K Verification	20.12 Check for machine level. 1 2 3 K Verification
20.13 Check water pump. 1 2 3 K Verification	20.14 Check water spray. 1 2 3 K Verification	20.15 Identify & explain the types of water treatment. 1 2 3 K Verification
1 2 3 K Verification	1 2 3 K Verification	1 2 3 K Verification
1 2 3 K Verification	1 2 3 K Verification	1 2 3 K Verification

0.0 DEMONSTRATE EMPLOYABILITY SKILLS.

0.01 Conduct a job search. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification

0.02 Secure information about a job. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification

0.03 Identify documents that may be required when applying for a job. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification

0.04 Complete a job application form correctly. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification

0.05 Demonstrate competence in job interview techniques. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification

0.06 Identify or demonstrate appropriate responses to criticism from employer, supervisor or other persons. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification

0.07 Identify acceptable work habits. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification

0.08 Demonstrate knowledge of how to make job changes appropriately. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification

0.09 Demonstrate acceptable employee health habits. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification

00.0 DEMONSTRATE AN UNDERSTANDING OF ENTREPRENEURSHIP.

00.01 Define entrepreneurship. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification

00.02 Describe the importance of entrepreneurship to the American economy. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification

00.03 List the advantages & disadvantages of business ownership. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification

00.04 Identify the risks involved in ownership of a business. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification

00.05 Identify the necessary personal characteristics of a successful entrepreneur. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification

00.06 Identify the business skills needed to operate a small business efficiently & effectively. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification

1 ☐ 2 ☐ 3 ☐ K ☐ Verification

1 ☐ 2 ☐ 3 ☐ K ☐ Verification

1 ☐ 2 ☐ 3 ☐ K ☐ Verification

P.O.W.E.R. SKILLS (PRINCIPLES OF WORK ENVIRONMENT READINESS)

000.0 COOPERATIVE WORK EXPERIENCE COMPETENCIES.

1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification
1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification
1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification
1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification
1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification
1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification
1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification

VERIFICATION

The instructor should verify the level of mastery achieved by the student by initialing the competency box each time the student masters a competency. Later, if the student achieves a higher degree of mastery of a competency, the higher degree should be recorded and verified by the instructor.

INSTRUCTOR SHOULD SIGN FULL NAME AND SCHOOL NAME AND ADDRESS IN THE SPACE BELOW.

Verification	Signature
	Title
	School Name
	School Address

Verification	Signature
	Title
	School Name
	School Address

Verification	Signature
	Title
	School Name
	School Address

COOPERATIVE WORK EXPERIENCE

In addition to classroom training and laboratory performance identified on the Career MAP, this student has participated in cooperative work experience with employers as shown below:

Dates _____

Employer _____

Address of Employer _____

Supervisor _____

Supervisor Title _____

Dates _____

Employer _____

Address of Employer _____

Supervisor _____

Supervisor Title _____

Dates _____

Employer _____

Address of Employer _____

Supervisor _____

Supervisor Title _____

NOTES

This section of the MAP is provided so the instructor, employer, or student may list additional qualifying statements or other pertinent information. All comments should be initialed for verification.

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